

WHAT IS CLAIMED IS:

1                   1.       A method for producing digital models of dental positioning  
2 appliances, said method comprising:  
3                   providing a digital model of a patient's dentition;  
4                   producing a plurality of modified digital models of the dentition, wherein the  
5 modified models represent successive stages of an orthodontic treatment;  
6                   providing a digital model of at least one attachment device; and  
7                   positioning the digital model of the attachment device on at least some of the  
8 plurality of modified digital models.

2                   2.       A method as in claim 1, wherein providing a digital model of the  
patient's dentition comprises scanning the patient's teeth.

2                   3.       A method as in claim 1, wherein providing a digital model of the  
patient's dentition comprises scanning a mold of the patient's teeth.

3                   4.       A method as in claim 1, wherein producing a plurality of modified  
digital models of the dentition comprises:  
4                   presenting a visual image based on the digital model of the patient's dentition;  
5                   manipulating the visual image to reposition individual teeth in the visual  
6 image;  
7                   producing a digital data set representing the final tooth arrangement with  
8 repositioned teeth as observed in the image; and  
9                   producing the plurality of modified digital models as a series of successive  
10 tooth arrangements progressing from the initial tooth arrangement to the final tooth  
arrangement.

1                   5.       A method as in claim 4, wherein the manipulating step comprises:  
2                   defining boundaries about at least some of the individual teeth; and  
3                   moving at least some of the tooth boundaries relative to the other teeth in an  
4 image based on the digital data set.

1                   6.       A method as in claim 1, wherein producing a plurality of modified  
2 digital models of the dentition comprises:  
3                   providing a computer system having at least one processor and memory;

4 providing to the computer system the digital model of the patient's dentition;  
5 providing to the computer system a digital model set representing a final tooth  
6 arrangement;  
7 producing using the computer system the plurality of models based on both of  
8 the previously provided initial and final digital data sets.

1 7. A method as in claim 6, wherein the step of providing a digital model  
2 set representing a final tooth arrangement comprises:

3 defining boundaries about at least some of the individual teeth on a visual  
4 image provided by the computer system; and

5 moving at least some of the tooth boundaries relative to the other teeth in the  
6 visual image to produce the final data set.

7 8. A method as in claim 6, wherein the step of producing the plurality of  
8 models comprises determining positional differences between the initial digital model and the  
9 final digital model and interpolating said differences.

10 9. A method as in claim 8, wherein the interpolating step comprises linear  
11 interpolation.

12 10. A method as in claim 8, wherein the interpolating step comprises non-  
13 linear interpolation.

14 11. A method as in claim 8, further comprising defining one or more key  
15 frames between the initial digital tooth model and final digital tooth model and interpolating  
16 between the key frames.

17 12. A method as in claim 1, wherein providing a digital model of at least  
18 one attachment device comprises selecting the digital model of the attachment from a library  
19 of such attachments.

20 13. A set of dental positioning appliances, said set comprising a plurality  
21 of thin shell removable appliances representing successive stages of an orthodontic treatment,  
22 wherein at least some of said appliances has a receptacle positioned to receive an attachment  
23 device on a patient's teeth when each of said appliances is successfully worn over the teeth  
24 during the orthodontic treatment.

1 , 14. A set of dental positioning appliances as in claim 13, including at least  
2 a first appliance, an intermediate appliance, and a final appliance.

1 15. A set of dental positioning appliances as in claim 14, including at least  
2 two intermediate appliances.

1 16. A set of dental positioning appliances as in claim 15, including at least  
2 ten intermediate appliances.

1 17. A set of dental positioning appliances as in claim 16, including at least  
2 twenty-five intermediate appliances.

1 18. A set of dental positioning appliances as in claim 13, wherein the tooth  
2 positions defined by the cavities in each appliance differ from those defined by an  
3 immediately prior appliance by no more than 2mm.

1 19. An improved method for repositioning teeth using appliances  
2 comprising polymeric shells having cavities shaped to receive and resiliently reposition teeth  
3 to a final tooth arrangement, wherein the improvement comprises:

4 placing an attachment device on at least one tooth of a patient; and  
5 providing a plurality of polymeric shell appliances to be worn successively by  
6 the patient to reposition the patient's teeth, wherein each of the appliance shells has a  
7 receptacle for receiving the attachment device when the shell appliance is worn over the teeth  
8 and wherein the position of the receptacle in the appliance is selected to transmit a force to  
9 move the tooth.

1 20. A method for fabricating a dental positioning appliance, said method  
2 comprising:

3 providing a digital model of a patient's teeth;  
4 providing a digital model of at least one attachment device;  
5 positioning the digital model of the attachment device on the digital model of  
6 the teeth to produce a combined digital model;  
7 fabricating the dental positioning appliance based on the combined digital  
8 model.